

# Canadian Journal of Earth Sciences

# Revue canadienne des sciences de la Terre

Contents  
Volume 33, 1996

Sommaire  
Volume 33, 1996

## January / Janvier

D.T.A. Symons, M.T. Lewchuk, and D.R. Boyle	Pliocene–Pleistocene genesis for the Murray Brook and Health Steel Au–Ag gossan ore deposits, New Brunswick, from paleomagnetism	1
Mark Pilkington and Walter R. Roest	An assessment of long-wavelength magnetic anomalies over Canada	12
Chris McGowan	A new and typically Jurassic ichthyosaur from the Upper Triassic of British Columbia	24
Randall F. Miller	Allerød – Younger Dryas Coleoptera from western Cape Breton Island, Nova Scotia, Canada	33
Véronique Dewez et Marie-Anne Geurts	Analyses minéralogiques multivariées de sédiments du Wisconsinien supérieur au sud-ouest du Yukon	42
Alan E. Taylor, Scott R. Dallimore, and S.I. Outcalt	Late Quaternary history of the Mackenzie–Beaufort region, Arctic Canada, from modelling of permafrost temperatures. 1. The onshore–offshore transition	52
Alan E. Taylor, Scott R. Dallimore, and Alan S. Judge	Late Quaternary history of the Mackenzie–Beaufort region, Arctic Canada, from modelling of permafrost temperatures. 2. The Mackenzie Delta – Tuktoyaktuk Coastlands	62
Brian Jones and Robin W. Renaut	Influence of thermophilic bacteria on calcite and silica precipitation in hot springs with water temperatures above 90°C: evidence from Kenya and New Zealand	72
Abdesselam El Kochri and Jean Chorowicz	Oblique extension in the Jurassic trough of the central and eastern High Atlas (Morocco)	84
A. Genna, M. Jébrak, E. Marcoux, and J.P. Milési	Genesis of cockade breccias in the tectonic evolution of the Cirotan epithermal gold system, West Java	93
R.A. Stevens, P. Erdmer, R.A. Creaser, and S.L. Grant	Mississippian assembly of the Nisutlin assemblage: evidence from primary contact relationships and Mississippian magmatism in the Teslin tectonic zone, part of the Yukon–Tanana terrane of south-central Yukon	103
Daniel H. Mann and Aron L. Crowell	A large earthquake occurring 700–800 years ago in Aialik Bay, southern coastal Alaska	117
Instructions to authors		I-1
Recommandations aux auteurs		R-1
NRC Research Press publication policy		iii
Presses scientifiques du CNRC, politique de publication		vi

## February / Février

### *Geological Studies in Atlantic Canada / Études géologiques du Canada atlantique*

Alan L. Sangster	Preface/Préface	127
Joseph B. Whalen, Leslie R. Fyffe, Frederick J. Longstaffe, and George A. Jenner	The position and nature of the Gander–Avalon boundary, southern New Brunswick, based on geochemical and isotopic data from granitoid rocks	129
Joseph B. Whalen, George A. Jenner, Frederick J. Longstaffe, and Ernst Hegner	Nature and evolution of the eastern margin of Iapetus: geochemical and isotopic constraints from Siluro-Devonian granitoid plutons in the New Brunswick Appalachians	140
S.M. Barr and C.E. White	Tectonic setting of Avalonian volcanic and plutonic rocks in the Caledonian Highlands, southern New Brunswick, Canada	156
Gregory Lynch and Peter S. Giles	The Ainslie Detachment: a regional flat-lying extensional fault in the Carboniferous evaporitic Maritimes Basin of Nova Scotia, Canada	169
Peter A. Cawood, Jeroen A.M. van Gool, and Greg R. Dunning	Geological development of eastern Humber and western Dunnage zones: Corner Brook – Glover Island region, Newfoundland	182
Benoît Dubé and Kathleen Lauzière	Structural evolution of a major fault zone: the Cape Ray Fault Zone, southwestern Newfoundland, Canada	199

D.T. James, J.N. Connelly, H.A. Wasteneys, and G.J. Kilfoil	Paleoproterozoic lithotectonic divisions of the southeastern Churchill Province, western Labrador	216
Wayne D. Goodfellow and Jan M. Peter	Sulphur isotope composition of the Brunswick No. 12 massive sulphide deposit, Bathurst Mining Camp, New Brunswick: implications for ambient environment, sulphur source, and ore genesis	231
Jan M. Peter and Wayne D. Goodfellow	Mineralogy, bulk and rare earth element geochemistry of massive sulphide-associated hydrothermal sediments of the Brunswick Horizon, Bathurst Mining Camp, New Brunswick	252
David R. Lentz and Wayne D. Goodfellow	Intense silicification of footwall sedimentary rocks in the stockwork alteration zone beneath the Brunswick No. 12 massive sulphide deposit, Bathurst, New Brunswick	284
M.M. Savard	Pre-ore burial dolomitization adjacent to the carbonate-hosted Gays River Zn-Pb deposit, Nova Scotia	303
F. Santaguida and M.D. Hannington	Characteristics of gold mineralization in volcanogenic massive sulphide deposits of the Notre Dame Bay area, central Newfoundland	316
Damien Gaboury, Benoît Dubé, Marc R. Laflèche, and Kathleen Lauzière	Geology of the Hammer Down mesothermal gold deposit, Newfoundland Appalachians, Canada	335
M.B. McClenaghan and R.N.W. DiLabio	Ice-flow history and glacial dispersal patterns, southeastern Cape Breton Island, Nova Scotia: implications for mineral exploration	351
R.A. Klassen and Julian B. Murton	Quaternary geology of the Buchans area, Newfoundland: implications for mineral exploration	363

### March / Mars

J. Brendan Murphy, J. Duncan Keppie, Jarda Dostal, John W.F. Waldron, and Mary Pat Cude	Geochemical and isotopic characteristics of Early Silurian clastic sequences in Antigonish Highlands, Nova Scotia, Canada: constraints on the accretion of Avalonia in the Appalachian-Caledonide Orogen	379
Daniel K. Kerr	Late Quaternary sea level history in the Paulatuk to Bathurst Inlet area, Northwest Territories	389
Ed Landing and Stephen R. Westrop	Upper Lower Cambrian depositional sequence in Avalonian New Brunswick	404
Carlos M. González-León, David G. Taylor, and George D. Stanley, Jr.	The Antimonio Formation in Sonora, Mexico, and the Triassic-Jurassic boundary	418
Alison M. Murray and Mark V.H. Wilson	A new Palaeocene genus and species of percopsiform (Teleostei: Paracanthopterygii) from the Paskapoo Formation, Smoky Tower, Alberta	429
Chris McGowan	The taxonomic status of <i>Leptopterygius</i> Huene, 1922 (Reptilia: Ichthyosauria)	439
Fabrice Cordey and Elizabeth S. Carter	New Nassellaria (Radiolaria) from the Lower Jurassic of the Canadian Cordillera	444
Bernard L. Mamet	Late Paleozoic small foraminifers (endothyrids) from South America (Ecuador and Bolivia)	452
Ian Reid	Crustal structure across the Nain-Makkovik boundary on the continental shelf off Labrador from seismic refraction data	460
Adrian F. Park	Structural evolution of sulphide tectonites and their host rocks, Stratmat mine, New Brunswick	472
Ross L. Sherlock	Hydrothermal alteration of volcanic rocks at the McLaughlin gold deposit, northern California	493

### ERRATUM

Catherine J. Hickson, James G. Moore, Lewis Calk, and Paul Metcalfe	Erratum: Intraglacial volcanism in the Wells Gray - Clearwater volcanic field, east-central British Columbia, Canada	509
---	--	-----

### April / Avril

#### Results from the Sino-Canadian Dinosaur Project, Part 2 / Résultats du Projet dinosaure sino-canadien, 2<sup>e</sup> partie

Philip J. Currie	Preface/Préface	v
Paul A. Johnston, D.A. Eberth, and Paul K. Anderson	Alleged vertebrate eggs from Upper Cretaceous redbeds, Gobi Desert, are fossil insect (Coleoptera) pupal chambers: <i>Fictovichnus</i> new ichnogenus	511
Donald Brinkman and Jiang-Hua Peng	A new species of <i>Zangerlia</i> (Testudines: Nanhsiungchelyidae) from the Upper Cretaceous redbeds at Bayan Mandahu, Inner Mongolia, and the relationships of the genus	526
Xiao-Chun Wu, Donald B. Brinkman, and Anthony P. Russell	<i>Sineoamphisbaena hexatabularis</i> , an amphisbaenian (Diapsida: Squamata) from the Upper Cretaceous redbeds at Bayan Mandahu (Inner Mongolia, People's Republic of China), and comments on the phylogenetic relationships of the Amphisbaenia	541
Keqin Gao and Lianhai Hou	Systematics and taxonomic diversity of squamates from the Upper Cretaceous Djadochta Formation, Bayan Mandahu, Gobi Desert, People's Republic of China	578
X.-C. Wu, H.-D. Sues, and D.B. Brinkman	An atoposaurid neosuchian (Archosauria: Crocodyliformes) from the Lower Cretaceous of Inner Mongolia (People's Republic of China)	599

<b>Xiao-Chun Wu, Donald B. Brinkman, and Anthony P. Russell</b> <i>Sunosuchus junggarensis</i> sp. nov. (Archosauria: Crocodyliformes) from the Upper Jurassic of Xinjiang, People's Republic of China	606
<b>Zhi-Ming Dong and Philip J. Currie</b> On the discovery of an oviraptorid skeleton on a nest of eggs at Bayan Mandahu, Inner Mongolia, People's Republic of China	631
<b>Dale A. Russell and X.-J. Zhao</b> New psittacosaur occurrences in Inner Mongolia	637

## May / Mai

<b>David Morin, Robert Marquis et Michel Jébrak</b> Un diatème phréatomagmatique montréalais dans les Appalaches du Québec	649
<b>J.C. Gutiérrez-Marco, A.C. Lenz, M. Robardet, and J.M. Piçarra</b> Wenlock–Ludlow graptolite biostratigraphy and extinction: a reassessment from the southwestern Iberian Peninsula (Spain and Portugal)	656
<b>Scott R. Dallimore, Stephen A. Wolfe, and Steven M. Solomon</b> Influence of ground ice and permafrost on coastal evolution, Richards Island, Beaufort Sea coast, N.W.T.	664
<b>M.R. La Flèche and G. Camiré</b> Geochemistry and provenance of metasedimentary rocks from the Archean Golden Pond sequence (Casa Berardi mining district, Abitibi subprovince)	676
<b>Sally Pehrsson, Simon Hanmer, and Otto van Breemen</b> U–Pb geochronology of the Raglan gabbro belt, Central Metasedimentary Belt, Ontario: implications for an ensialic marginal basin in the Grenville Orogen	691
<b>R.R. Reisz and S.P. Modesto</b> <i>Archerpeton anthracos</i> from the Joggins Formation of Nova Scotia: a microsauro, not a reptile	703
<b>David J. Mossman and Robert G. Grantham</b> A recently discovered amphibian trackway ( <i>Dromilopus quadrifidus</i> ) at Joggins, Nova Scotia	710
<b>R.N. Adair and R.A. Burwash</b> Evidence for pyroclastic emplacement of the Crowsnest Formation, Alberta	715
<b>C. Long and M.H. Salisbury</b> The velocity structure of the Britt Domain, southwestern Grenville Province, from laboratory and refraction experiments	729
<b>John K. Park and Charles F. Gower</b> Paleomagnetism of pre-Grenvillian mafic rocks from the northeast Grenville Province, Labrador: implications for the Grenville Track	746
<b>David M. Fountain and Matthew H. Salisbury</b> Seismic properties of rock samples from the Pikwitonei granulite belt – God's Lake domain crustal cross section, Manitoba	757
<b>Paul E. Carrara, Eugene P. Kiver, and Dale F. Stradling</b> The southern limit of Cordilleran ice in the Colville and Pend Oreille valleys of northeastern Washington during the Late Wisconsin glaciation	769
<b>John England</b> Glacier dynamics and paleoclimatic change during the last glaciation of eastern Ellesmere Island, Canada	779
<b>Edward D. Ghent, Philippe Erdmer, Douglas A. Archibald, and Mavis Z. Stout</b> Pressure–temperature and tectonic evolution of Triassic lawsonite–aragonite blueschists from Pinchi Lake, British Columbia	800
<b>Karen A. Connors</b> Unraveling the boundary between turbidites of the Kiseeynew belt and volcano-plutonic rocks of the Flin Flon belt, Trans-Hudson Orogen, Canada	811

## June / Juin

<b>D.L. Southwick and Val W. Chandler</b> Block and shear-zone architecture of the Minnesota River Valley subprovince: implications for late Archean accretionary tectonics	831
<b>R.W. Dalrymple and G.M. Narbonne</b> Continental slope sedimentation in the Sheepbed Formation (Neoproterozoic, Windermere Supergroup), Mackenzie Mountains, N.W.T.	848
<b>D. Marchioni, M. Gibling, and W. Kalkreuth</b> Petrography and depositional environment of coal seams in the Carboniferous Morien Group, Sydney Coalfield, Nova Scotia	863
<b>A. Duk-Rodkin, R.W. Barendregt, C. Tarnocai, and F.M. Phillips</b> Late Tertiary to late Quaternary record in the Mackenzie Mountains, Northwest Territories, Canada: stratigraphy, paleosols, paleomagnetism, and chlorine-36	875
<b>R.W. Barendregt, R.J. Enkin, A. Duk-Rodkin, and J. Baker</b> Paleomagnetic evidence for late Cenozoic glaciations in the Mackenzie Mountains of the Northwest Territories, Canada	896
<b>L.E. Jackson, Jr., R.W. Barendregt, J. Baker, and E. Irving</b> Early Pleistocene volcanism and glaciation in central Yukon: a new chronology from field studies and paleomagnetism	904
<b>S. Vanderburgh and M.C. Roberts</b> Depositional systems and seismic stratigraphy of a Quaternary basin: north Okanagan Valley, British Columbia	917
<b>Alexander P. Wolfe</b> A high-resolution late-glacial and early Holocene diatom record from Baffin Island, eastern Canadian Arctic	928
<b>W. Kalkreuth and M. McMechan</b> Coal rank and burial history of Cretaceous–Tertiary strata in the Grande Cache and Hinton areas, Alberta, Canada: implications for fossil fuel exploration	938

- M. Queen, L.M. Heaman, J.A. Hanes, D.A. Archibald, and E. Farrar <sup>40</sup>Ar/<sup>39</sup>Ar phlogopite and U-Pb perovskite dating of lamprophyre dykes from the eastern Lake Superior region: evidence for a 1.14 Ga magmatic precursor to Midcontinent Rift volcanism 958

## July / Juillet

- W.D. Maier, S.-J. Barnes, and T. Pellet The economic significance of the Bell River Complex, Abitibi subprovince, Quebec 967
- M.L. Vinyu, R. Frei, and H.A. Jelsma Timing between granitoid emplacement and associated gold mineralization: examples from the ca. 2.7 Ga Harare-Shamva greenstone belt, northern Zimbabwe 981
- M. Aberhan and J. Pálffy A low oxygen tolerant East Pacific flat clam (*Posidonotis semiplicata*) from the Lower Jurassic of the Canadian Cordillera 993
- K. Halder and S. Bardhan The fleeting genus *Cymatonautilus* (Nautiloidea): new record from the Jurassic Chari Formation, Kutch, India 1007
- Chris McGowan Giant ichthyosaurs of the Early Jurassic 1011
- Lin Rui and W.W. Nassichuk Upper Permian (Wordian) fusulinaceans from the Cache Creek Terrane, northern British Columbia 1022
- P. Ted Doughty and Kevin R. Chamberlain Salmon River Arch revisited: new evidence for 1370 Ma rifting near the end of deposition in the Middle Proterozoic Belt basin 1037
- David Schneider, Daniel Holm, and Daniel Lux On the origin of Early Proterozoic gneiss domes and metamorphic nodes, northern Michigan 1053
- Philip R. Hill Late Quaternary sequence stratigraphy of the Mackenzie Delta 1064
- Trevor Bell The last glaciation and sea level history of Fosheim Peninsula, Ellesmere Island, Canadian High Arctic 1075
- N. Wodicka, R.R. Parrish, and R.A. Jamieson The Parry Sound domain: a far-travelled allochthon? New evidence from U-Pb zircon geochronology 1087

## August / Août

- G.E. Ray, G.L. Dawson, and I.C.L. Webster The stratigraphy of the Nicola Group in the Hedley district, British Columbia, and the chemistry of its intrusions and Au skarns 1105
- Darla K. Zelenitsky and L.V. Hills An egg clutch of *Prismatoolithus levis* oosp. nov. from the Oldman Formation (Upper Cretaceous), Devil's Coulee, southern Alberta 1127
- Sylvain Desbiens, Thomas E. Bolton, and Alexander D. McCracken Fauna of the lower Beauharnois Formation (Beekmantown Group, Lower Ordovician), Grande-Île, Quebec 1132
- John Shaw, Bruce Rains, Ronald Eyton, and Lee Weissling Laurentide subglacial outburst floods: landform evidence from digital elevation models 1154
- M.G. Mihalynuk and E.D. Ghent Regional depth-controlled hydrothermal metamorphism in the Zymoetz River area, British Columbia 1169
- Ed Landing Reconstructing the Avalon continent: marginal to inner platform transition in the Cambrian of southern New Brunswick 1185
- Pierre A. Cousineau and Robert Marquis Contrasting fold styles in a volcano-sedimentary succession 1193
- C. Wright Faulting and overburden and bedrock seismic velocities at Buchans and Gullbridge, Newfoundland, from seismic refraction measurements: applications to shallow geology and exploration 1201
- Wouter Bleeker and Randall R. Parrish Stratigraphy and U-Pb zircon geochronology of Kidd Creek: implications for the formation of giant volcanogenic massive sulphide deposits and the tectonic history of the Abitibi greenstone belt 1213

## September / Septembre

- J. Allan Donaldson, Pablo G. Guerstein, and Wulf Mueller Facies analysis of a pumiceous terrace beside Klutlan Glacier, Yukon Territory 1233
- Lawrence B. Aspler and Jeffrey R. Chiarenzelli Relationship between the Montgomery Lake and Hurwitz groups, and stratigraphic revision of the lower Hurwitz Group, District of Keewatin 1243
- R.L. Kellett and B. Rivard Characterization of the Benny deformation zone, Sudbury, Ontario 1256
- Kevin J. Smart, Terry L. Pavlis, Virginia B. Sisson, Sarah M. Roeske, and Lawrence W. Snee The Border Ranges fault system in Glacier Bay National Park, Alaska: evidence for major early Cenozoic dextral strike-slip motion 1268
- Nicolas Pinet, Sébastien Castonguay, and Alain Tremblay Thrusting and back thrusting in the Taconian internal zone, southern Quebec Appalachians 1283



<b>A.J. Calvert</b> Seismic reflection constraints on imbrication and underplating of the northern Cascadia convergent margin	1294
<b>Hardolph A. Wasteneys, Richard J. Wardle, and Thomas E. Krogh</b> Extrapolation of tectonic boundaries across the Labrador shelf: U-Pb geochronology of well samples	1308
<b>J.N. Connelly and B. Ryan</b> Late Archean evolution of the Nain Province, Nain, Labrador: imprint of a collision	1325
<b>Guy Sénéchal, Marianne Mareschal, Claude Hubert, Andrew J. Calvert, Gilles Grandjean, and John Ludden</b> Integrated geophysical interpretation of crustal structures in the northern Abitibi belt: constraints from seismic amplitude analysis	1343

## October / Octobre

<b>M. Bouabdellah, Y. Héroux et A.C. Brown</b> Pétrographie et altération de la matière organique du gisement de plomb-zinc-cuivre de Beddiane, district de Touissit - Bou Beker, Maroc nord oriental	1363
<b>Christopher Fielitz</b> A Late Cretaceous (Turonian) ichthyofauna from Lac des Bois, Northwest Territories, Canada, with paleo-biogeographic comparisons with Turonian ichthyofaunas of the Western Interior Seaway	1375
<b>Alfred C. Lenz, Xu Chen, and Yu-nan Ni</b> Wenlock, Ludlow, and Pridoli? graptolites from Yulin, Guangxi, China	1390
<b>Wayne G. Powell and Edward D. Ghent</b> Low-pressure metamorphism of the mafic volcanic rocks of the Rossland Group, southeastern British Columbia	1402
<b>R.B. Laidler and D.B. Scott</b> Foraminifera and Arcellacea from Porters Lake, Nova Scotia: modern distribution and paleodistribution	1410
<b>Ian S. Spooner, Gerald D. Osborn, R. Barendregt, and E. Irving</b> A Middle Pleistocene (isotope stage 10) glacial sequence in the Stikine River valley, British Columbia	1428
<b>M. Jane Bunting, Barry G. Warner, and Ramon Aravena</b> Late Quaternary vegetation dynamics and hydrosere development in a <i>Thuja occidentalis</i> swamp in southern Ontario	1439
<b>Peter W. Uitterdijk Appel</b> Minturn circles: a new glacial feature	1457
<b>B.I. Cameron and G.K. Muecke</b> Permian alkaline basalts associated with formation of the Sverdrup Basin, Canadian Arctic	1462

## November / Novembre

<b>R. Andrew MacRae, L.V. Hills, and D.J. McIntyre</b> The paleoecological significance of new species of <i>Limbicysta</i> (Acritarcha) from the upper Albian of the Canadian Arctic Islands	1475
<b>Mark V.H. Wilson</b> Taphonomy of a mass-death layer of fishes in the Paleocene Paskapoo Formation at Joffre Bridge, Alberta, Canada	1487
<b>William F. Manley</b> Late-glacial flow patterns, deglaciation, and postglacial emergence of south-central Baffin Island and the north-central coast of Hudson Strait, eastern Canadian Arctic	1499
<b>P. Leclaire, J. Aguirre-Puente et F. Cohen-Ténoudji</b> Étude théorique et expérimentale de la propagation acoustique dans les milieux poreux soumis au gel	1511
<b>K.Y. Tomlinson, R.P. Hall, D.J. Hughes, and P.C. Thurston</b> Geochemistry and assemblage accretion of metavolcanic rocks in the Beardmore-Geraldton greenstone belt, Superior Province	1520
<b>A.A. Hassanipak, A. Mohamad Ghazi, and J.M. Wampler</b> Rare earth element characteristics and K-Ar ages of the Band Ziarat ophiolite complex, southeastern Iran	1534
<b>Stephen T. Johnston, James K. Mortensen, and Philippe Erdmer</b> Igneous and metaigneous age constraints for the Aishihik metamorphic suite, southwest Yukon	1543
<b>Jean-Philippe Desrochers and Claude Hubert</b> Structural evolution and early accretion of the Archean Malartic Composite Block, southern Abitibi greenstone belt, Quebec, Canada	1556
<b>J.L. Crowley, E.D. Ghent, and R.L. Brown</b> Metamorphism in the Clachnacudainn terrane and implications for tectonic setting in the southern Omineca Belt, Canadian Cordillera	1570

## December / Décembre

<b>Kenneth L. Buchan, Henry C. Halls, and James K. Mortensen</b> Paleomagnetism, U-Pb geochronology, and geochemistry of Marathon dykes, Superior Province, and comparison with the Fort Frances swarm	1583
<b>Bradford J. Johnson and Richard L. Brown</b> Crustal structure and early Tertiary extensional tectonics of the Omineca belt at 51°N latitude, southern Canadian Cordillera	1596
<b>B. Bock, S.M. McLennan, and G.N. Hanson</b> The Taconian orogeny in southern New England: Nd-isotope evidence against addition of juvenile components	1612

<b>Arthur S. Dyke, Roger N. McNeely, and James Hooper</b> Marine reservoir corrections for bowhead whale radiocarbon age determinations	1628
<b>Min Sun, Kurt Kyser, Mel Stauffer, Rob Kerrich, and John Lewry</b> Constraints on the timing of crustal imbrication in the central Trans-Hudson Orogen from single zircon $^{207}\text{Pb}/^{206}\text{Pb}$ ages of granitoid rocks from the Pelican thrust zone, Saskatchewan	1638
<b>Stephen S. Harlan, Lawrence W. Snee, and John W. Geissman</b> $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology and paleomagnetism of Independence volcano, Absaroka Volcanic Supergroup, Beartooth Mountains, Montana	1648
<b>Darla K. Zelenitsky, L.V. Hills, and Philip J. Currie</b> Parataxonomic classification of ornithoid eggshell fragments from the Oldman Formation (Judith River Group; Upper Cretaceous), southern Alberta	1655
<b>Note of appreciation / Note de reconnaissance</b>	iii
<b>Author Index for Volume 33 / Index des auteurs pour volume 33</b>	AI-1
<b>Contents for Volume 33 / Sommaire pour volume 33</b>	C-1

